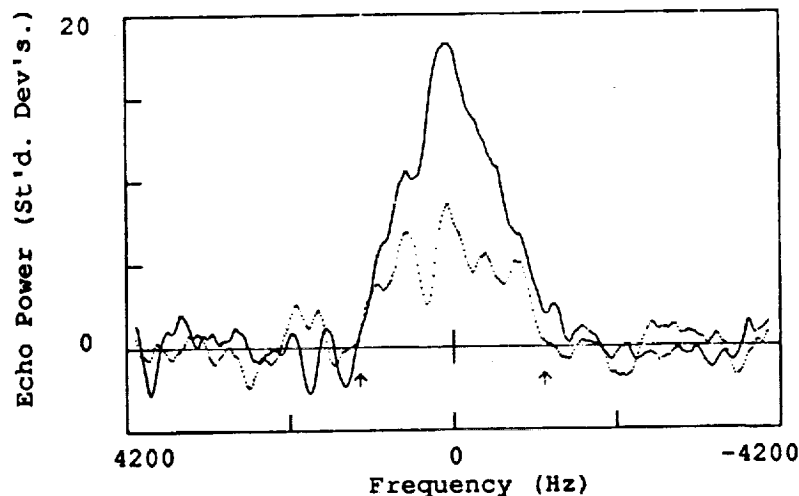


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Arecibo 13-cm-wavelength radar observations during 1987-90 have yielded echoes from Io on each of 11 dates. Whereas Voyager imaged parts of the satellite at resolutions of several km and various visible/infrared measurements have probed the surface's microscale properties, the radar data yield new information about the nature of the surface at cm-to-km scales. Our observations provide fairly thorough longitude coverage and reveal significant heterogeneity in Io's radar properties.



The figure shows sums of echo spectra from the 11 dates, obtained in the same circular polarization as transmitted (SC, dotted curve) and in the opposite circular (OC, solid curve). The frequency resolution is 240 Hz, or 10% of the limb-to-limb bandwidth; arrows indicate expected positions of the spectral edges. The OC spectrum, which includes echoes due to single back-reflections from large, smooth surface elements, is much broader than lunar OC spectra. Io's average SC/OC ratio is about 0.5, an order of magnitude larger than the corresponding value for the Moon. Io's 13-cm, total-power geometric albedo averages about 0.06, three times the lunar value. These results show Io's surface to be much rougher than the Moon's at virtually all scales from a few centimeters up to the resolution of Voyager images.